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(19) (CA) APPLICATION FOR CANADIAN PATENT (12)

(54) Process for Making Fibre Reinforced Cellular Cementious Building Materials

(72) Bellingham, Ramsay - Canada ;

(71) Same as inventor

(57) 2 Claims

Notice: This application is as filed and may therefore contain an incomplete specification.

CANADA

ABSTRACT OF THE DISCLOSURE

A process for making fibre reinforced cellular cementious building materials. Firstly, mix separately a foam slurry and a cementious mixture containing water and random glass fibres. Secondly, combine the foam slurry with the cementious mixture in a container to form a cellular cementious slurry containing random glass fibres. The container has a bottom with an orifice positioned adjacent the bottom. Thirdly, pull two parallel spaced layers of integrally formed glass fibre reinforcing mesh through the mixing container filled with cellular cementious slurry and out through the orifice into a drying tray. As the reinforcing mesh passes through the mixing container it pulls along with it cellular cementious slurry. The orifice restricts the amount of cellular cementious slurry that is drawn into the drying tray, thereby serving to gauge the dimensions of the building material. Fourthly leave the cellular cementious slurry to cure in the drying tray until the cellular cementious slurry has set thereby resulting in a cellular cementious building material having two reinforcing layers of integrally formed glass fibre mesh with random glass fibres extending between the two layers of integrally formed glass fibre mesh.

TITLE OF THE INVENTION:

Process for making fibre reinforced cellular cementious building materials

NAME OF INVENTOR:

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FIELD OF THE INVENTION

The present invention relates to a process for making fibre reinforced cellular cementious building materials, including all main structural components.

BACKGROUND OF THE INVENTION

International Patent Application PCT/F192/00233 published under the provisions of the Patent Cooperation Treaty March 17, 1994 as International Publication Number WO 94/05605, discloses a fibre reinforced cellular cementious insulation board. The advantages of such material are discussed in the application, namely; light weight, tensile strength along with a thermal insulation capacity. The manufacturing process is not disclosed. The resulting product is soft and consequently, is not capable of being used for structural building components.

The specification of U.K. Patent Application 2,225,599A published June 6, 1990 discusses a method of producing fibre reinforced cellular gypsum ceiling tile. A highly foamed slurry of gypsum material is poured onto a moving conveyor belt on which is positioned a layer of glass fibre tissue material. A further layer of glass fibre tissue material is then placed upon the surface of the slurry and passed beneath a gauging

device which determines the thickness of the resulting board. The slurry is then allowed to penetrate the layers of fibrous material before the gypsum material sets. The slurry of consists of gypsum material mixed with water into which air has been entrapped with the help of a surfactant foaming or air-entraining agent. The process employed in the manufacture of such fibre reinforced cellular building materials has an effect on the ultimate quality of the building materials produced. The U.K. Patent Application contains a warning that vibration of the conveyor belt must be avoided, as it has the undesirable effect of reducing the degree of foaming of the slurry, thereby increasing the density of the product. However, in the absence of vibration there is imperfect penetration of the slurry into the fibrous tissue.

SUMMARY OF THE INVENTION

What is required is a process for making fibre reinforced cellular cementious building materials that will produce building materials capable of being used as structural members.

According to one aspect of the present invention there is provided a process for making fibre reinforced cellular cementious building materials. Firstly, mix separately a foam slurry and a cementious mixture containing water and random glass fibres. Secondly, combine the foam slurry with the cementious mixture in a container to form a cellular cementious slurry containing random glass fibres. The container has a bottom with an orifice positioned adjacent the bottom. Thirdly, pull two parallel spaced layers of integrally formed glass fibre reinforcing mesh through the mixing container filled with cellular cementious slurry and out through the orifice into a curing tray. As the reinforcing mesh passes through the mixing container it pulls along with it cellular cementious slurry. The orifice restricts the amount of cellular cementious slurry that is drawn into the curing tray, thereby serving to gauge

the dimensions of the building material. Fourthly leave the cellular cementious slurry to cure in the curing tray until the cellular cementious slurry has set thereby resulting in a cellular cementious building material having two reinforcing layers of integrally formed glass fibre mesh with random glass fibres extending between the two layers of integrally formed glass fibre mesh.

With the process, as described above, the random glass fibres become interconnected with the integrally formed glass fibre mesh to improve the tensile strength of the resulting product. Using the described process materials can be fabricated that will substitute for plywood, drywall, studs, rafters, beams, siding, shingles, shakes, soffits, doors, and strapping. The resulting products can be made with sufficient strength that they are capable of serving as structural members. There is minimal disturbance during processing so the cementious slurry remains highly foamed resulting in a unique combination of light weight and strength. The resulting building materials can be cut, nailed, and otherwise used as wood building materials are currently used. The resulting materials are substantially the same weight as wood and can be used much like wood, but are fireproof and considerably less costly. The building materials can be made, using the described process, out of waste materials such as fly ash, blast furnace slag, silica fume, gypsum, limestone and broken glass. These waste materials are mixed with sand, and cement to form a strong cementious mixture.

According to another aspect of the present invention, there is provided a building material which includes a cellular cementious body having at least two layers of integrally formed glass fibre reinforcing mesh with random glass fibres extending between the at least two layers of integrally formed glass fibre reinforcing mesh. It is preferred that zirconium glass fibres be used.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the invention will become more apparent from the following description in which reference is made to the appended drawings, wherein:

FIGURE 1 is a diagrammatic representation of the preferred process for making fibre reinforced cellular cementious building materials.

FIGURE 2 is cutaway perspective view of a building material made in accordance with the teachings of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A process for making fibre reinforced cellular cementious building materials will now be described with reference to **FIGURES 1** and **2**.

Referring to **FIGURE 1**, the ingredients selected to be included in the cementious mixture are placed in a turntable portioning device 12. As previously described, these ingredients include random glass reinforcing fibres, sand and cement; together with such materials as fly ash, blast furnace slag, silica fume, broken glass, gypsum and limestone. The chosen mixture of ingredients are delivered on a continuous basis to first mixer 14. The steps in the process are as follows: Firstly, mix separately a foam slurry in a second mixer 16 and a cementious mixture containing water and zirconium random glass fibres in first mixer 14. Secondly, *combine the foam slurry* from second mixer 16 with the cementious mixture from first mixer 14 in a third mixer 17 to form a cellular cementious slurry containing random glass fibres. The contents of third mixer 17 are then discharged into a container 18. Container 18 has a bottom 20 with an adjustable orifice 22 positioned adjacent bottom 20. Thirdly, pull two parallel spaced layers of integrally formed zirconium

glass fibre reinforcing mesh 24 and 26 through mixing container 18 filled with cellular cementious slurry and out through adjustable orifice 22 into a curing tray 28. Reinforcing mesh 24 and 26 are pulled by cables 30 and 32, respectively. Cables 30 and 32 depend from an overhead loop cable 34 to pull reinforcing mesh 24 and 26 slowly to the end of curing tray 28. Reinforcing mesh 24 and 26 are fed from feed stock rollers 36 and 38, respectively. Reinforcing mesh 24 engages positioning roller 40 and reinforcing mesh 26 engages a lip 42 of orifice 22 which helps to maintain reinforcing mesh 24 and 26 in parallel spaced relation. As reinforcing mesh 24 and 26 pass through mixing container 18 they pull along with it cellular cementious slurry 44 containing random glass fibres 46 which tend to engage reinforcing mesh 24 and 26. This process is referred to as "pultrusion". Orifice 22 restricts the amount of cellular cementious slurry 44 that is drawn into curing tray 28, thereby serving to gauge the dimensions of the resulting building material. At least one polishing roller 45 is preferably positioned downstream of orifice 22. Polishing roller 45 is also capable of patterning or embossing the resulting product. Fourthly, leave cellular cementious slurry 44 to cure in curing tray 28 until cellular cementious slurry 28 has set.

Referring to **FIGURE 2**, the process, as described above, results in a building material 48 having a cellular cementious material 44 with two reinforcing layers of integrally formed glass fibre mesh 24 and 26. Random glass fibres 46 extend between glass fibre mesh 24 and 26. A portion of random glass fibres 46 become interconnected with glass fibre mesh 24 and 26 to improve the tensile strength of building material 48.

Referring to **FIGURE 1**, it is preferred that curing tray 28 be equipped with rollers 50 which are positioned on laterally extending rails 52. When one curing tray is filled it can be pushed laterally out of the way to cure, and a second curing tray can be used so the process is disrupted only

temporarily to switch trays.

The preferred mixture (apart from water and air which averages 50% by volume) is blast furnace slag 40%, sands 40%, fly ash 10%, portland cement 5%, silica fume 3%, and zirconium glass fibres 2%. It is preferred that the cementious mixture have a low pH level. Curing trays 28 can be practically any length, approximately 100 yards long is preferred. It will be appreciated that the size of orifice 22 determines whether flat boards, or dimension lumber is produced such as 2 x 4, 2 x 10, etc. Buildings can be constructed with the described materials. In fact, the process described can produce all the materials necessary for an entire building construction system, including all structural components. The buildings are built by the usual "framing" techniques employed by carpenters accustomed to working with wood. The materials can positioned in place by screws, nails, and glue and then bonded together <u>in situ</u> by pouring a very light weight short-fibre reinforced cellular concrete into empty wall spaces. The cellular concrete not only bonds the building components together, but also serves as insulation and sound proofing. Buildings made from the described materials are low cost, as they utilize in large part waste materials, as previously described. The materials can be specially adapted for their intended purposes by adding ingredients to the slurry, adding a step to the process or by subsequent treatment while the product is curing in the curing tray. Such treatments include embossing, colouring, and surface hardening by trays, paddle wheels, or other means.

It will be apparent to one skilled in the art that modifications may be made to the illustrated embodiment without departing from the spirit and scope of the invention as hereinafter defined in the Claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A process for making fibre reinforced cellular cementious building materials, comprising the steps of:

firstly, mixing separately a foam slurry and a cementious mixture containing water and random glass fibres;

secondly, combining the foam slurry with the cementious mixture in a container to form a cellular cementious slurry containing random glass fibres, the container having a bottom with an orifice positioned adjacent the bottom;

thirdly, pulling two parallel spaced layers of integrally formed glass fibre reinforcing mesh through the mixing container filled with cellular cementious slurry and out through the orifice into a drying tray, the reinforcing mesh pulling along with it cellular cementious slurry from the mixing container, the orifice restricting the amount of cellular cementious slurry that is drawn into the drying tray, thereby serving to gauge the dimensions of the building material; and

fourthly leaving the cellular cementious slurry to cure in the drying tray until the cellular cementious slurry has set thereby resulting in a cellular cementious building material having two reinforcing layers of integrally formed glass fibre mesh with random glass fibres extending between the two layers of integrally formed glass fibre mesh.

2. A building material, comprising:

a cellular cementious body having at least two layers of integrally formed glass fibre reinforcing mesh, with random glass fibres extending between the at least two layers of integrally formed glass fibre reinforcing mesh.

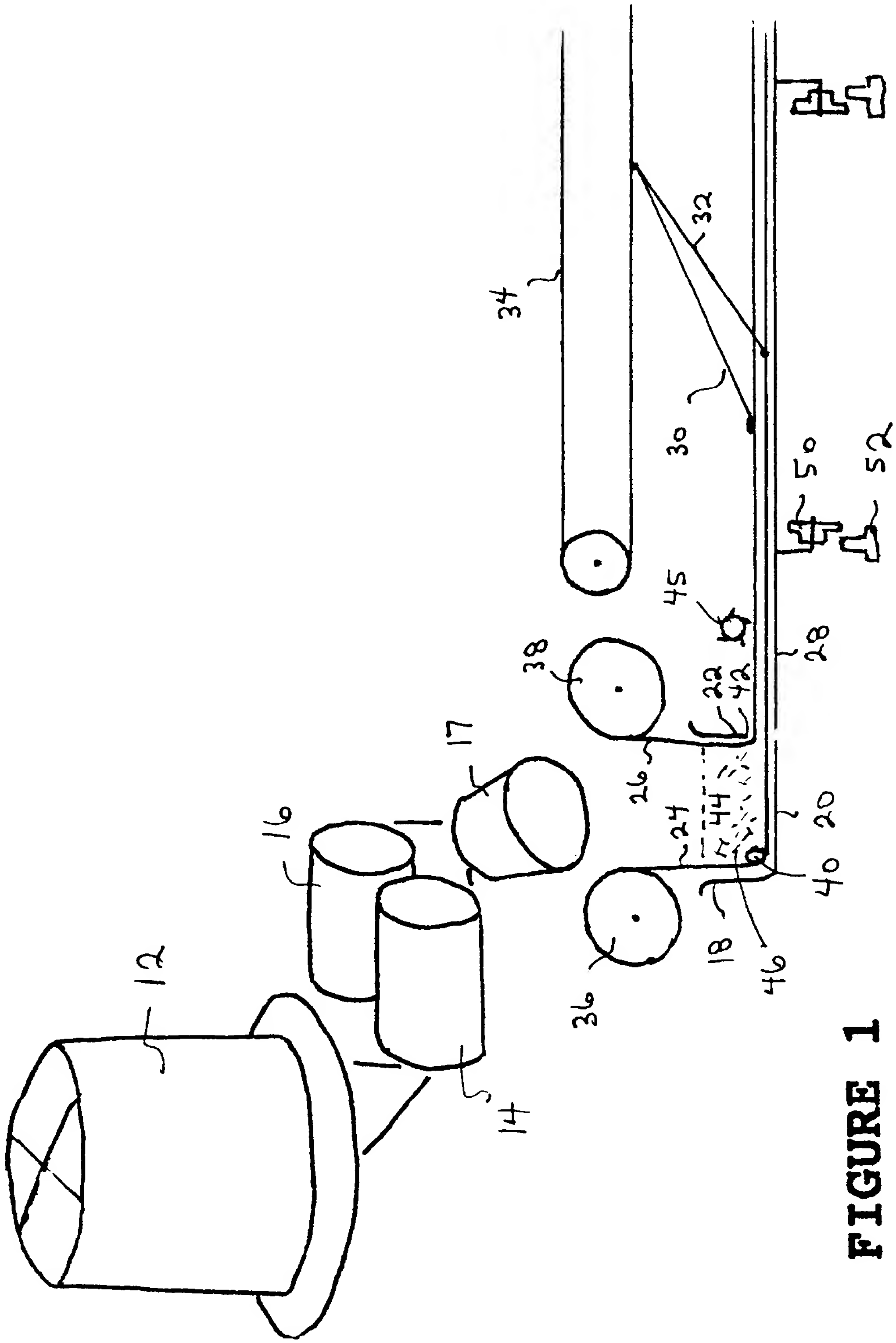

FIGURE 1

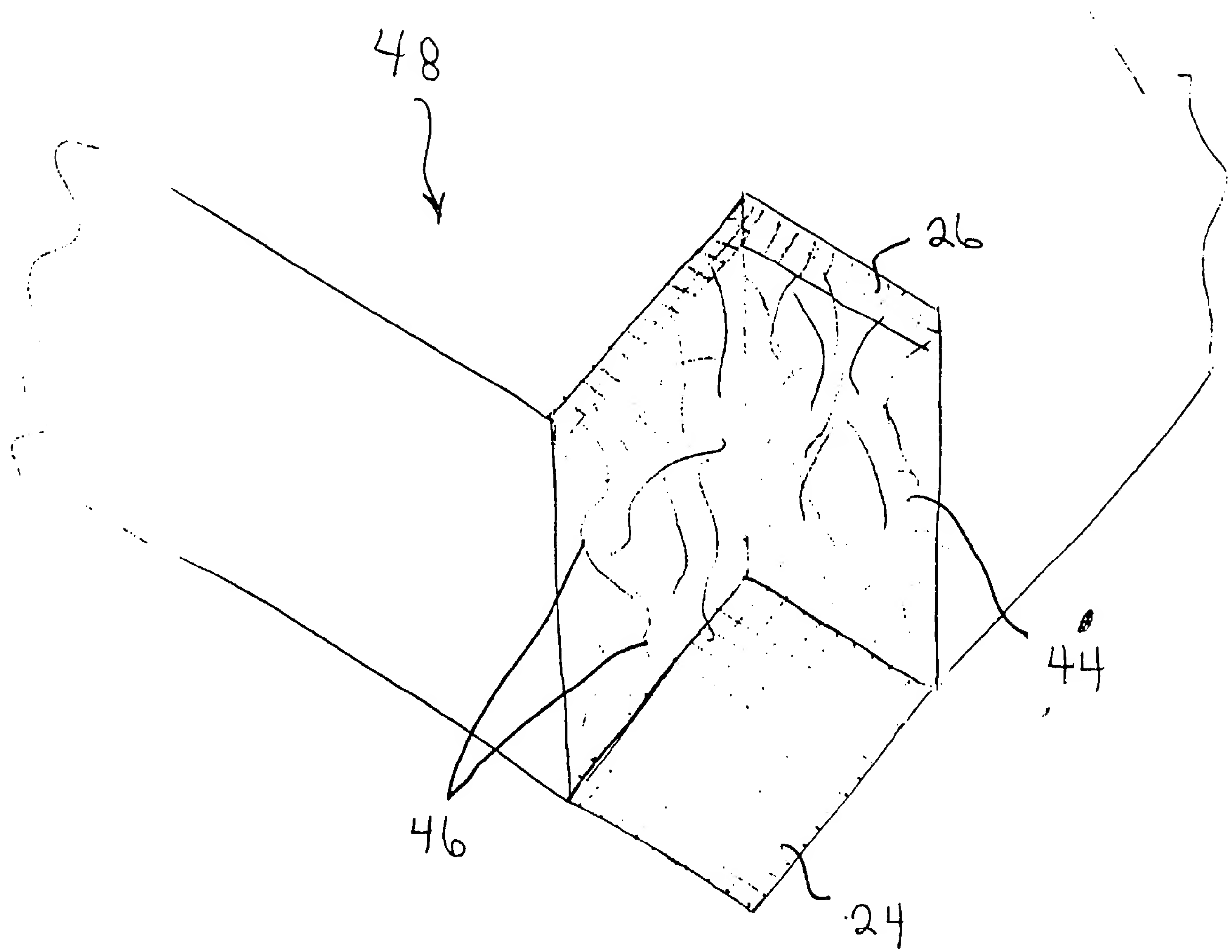

FIGURE 2